30.12
I96b

MOSCOW, MARCH, 1934 EXTENSION BULLETIN NO. 80

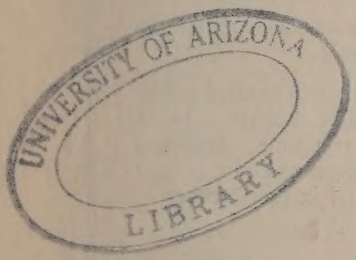
UNIVERSITY OF IDAHO
COLLEGE OF AGRICULTURE
EXTENSION DIVISION

E. J. IDDINGS
Director

How To Control Grasshoppers

(Revised)

By W. E. SHULL



COOPERATIVE EXTENSION SERVICE IN AGRICULTURE AND HOME ECONOMICS OF THE STATE OF IDAHO UNIVERSITY OF IDAHO EXTENSION DIVISION AND UNITED STATES DEPARTMENT OF AGRICULTURE COOPERATING

ENTOMOLOGY SECTION

Printed and distributed in furtherance of the purposes of the Cooperative Agricultural Extension Service provided for in Act of Congress May 8, 1914.

Grasshoppers are usually abundant enough in some parts of the State to cause severe damage to agricultural crops. A careful examination of each field should be made every year; in the fall for eggs and in the early spring for young 'hoppers, in order to determine the need for the application of control. A procedure for careful examination is outlined in this Bulletin.

Grasshoppers are capable of destroying many kinds of crops. Practically every cultivated crop grown in the State may be severely injured by these insects.

Crop destruction means the loss of many dollars to the farmer. This loss can be prevented.

Cultivation and poisoned bran bait will control grasshoppers if done as suggested in this Bulletin. These controls must be applied at the correct time. Poisoned bait control can be applied at a lower cost per acre if applied early in the spring instead of in the summer as is often done.

How To Control Grasshoppers

By

W. E. SHULL[1]

GRASSHOPPERS have been increasing in many parts of Idaho for the past few seasons. A recent survey has shown the insects to be present in much larger numbers than normal in certain parts of the State. The survey has also shown that in certain other sections of the State grasshoppers are less numerous than they have been in former years and in some counties the present populations are about normal. There are sufficient grasshoppers in some parts of the State every year to require control.

Species Involved

Numerous species of grasshoppers are found in Idaho. Three species, however, are of chief economic importance throughout the entire state. The two-striped grasshopper[2] is the most important, with the lesser migratory grasshopper[3] and the warrior grasshopper[4] ranking respectively second and third in order of economic importance. Two other economic species, the red-legged grasshopper[5] and Packard's grasshopper[6], are found in relatively small numbers in a few localities.

The two-striped grasshopper is a large, more or less yellow, slightly robust species. It varies from 1 to 1½ inches in length. The plain yellowish-brown body is marked by two yellow stripes, one along each side of the back extending from the head to the end of the wings. A dark, almost black, lengthwise stripe covers the upper half of the largest segment of the hind leg.

The lesser migratory grasshopper is dull brown to dark olive green in color with a distinct row of small black spots in the middle of the wing, a dark broken bar on each side of the body, in front of the wings, and red, yellow or blue on the long, slender spiny segment of the hind leg. The wings are usually longer than the abdomen. This species is distinguished from the red-legged grasshopper with considerable difficulty.

The warrior grasshopper is variable in color from light yellow to dark brown with large, well defined black spots on the wings, and two yellowish lines extending from the base of the wing to about one-third the distance from the base. This species is small and averages hardly over an inch in length when mature.

Life History

The life cycles of the injurious species of grasshoppers found in Idaho are so similar that they can easily be discussed in common.

(1) Assistant Entomologist, Experiment Station; Assistant Extension Entomologist.
(2) *Melanoplus bivittatus* Say.
(3) *Melanoplus mexicanus* Saussure.
(4) *Camnula pellucida* (Scudder).
(5) *Melanoplus femur-rubrum* (De Geer).
(6) *Melanoplus foedus foedus* Scudder.

During the latter part of the summer and the fall the mature females search out suitable places for depositing their eggs. They lay many eggs on warm bright days and if favorable weather continues for several weeks they are able to deposit enough eggs to greatly increase their populations in a single season. The eggs are deposited in pods in the ground, remaining there until warm weather comes in the spring. Hatching usually begins in April and may continue until early July, depending upon the species involved and the continuity of warm weather.

Most of the injurious species will reach maturity in from 60 to 90 days after hatching. The first adults may appear in July and there may still be immature grasshoppers in September or later. Soon after reaching maturity the adults mate and egg-laying begins.

Egg-Laying Habits

The adult grasshopper deposits her eggs in pods varying from ¾ of an inch to 1½ inches in length. Each pod may contain from 15 to 100 eggs. One female may deposit several pods during a season. The pods are usually placed in firm, uncultivated soil.

Where to Find the Eggs

Grasshopper egg pods are deposited from ½ inch to 3 inches deep. They are usually placed in the more compact soil along ditch banks, roadways, fence rows, around straw and hay stacks, and the edges of half-buried stones. Some species deposit many eggs in very small areas while other species deposit their eggs over larger areas, but they are always deposited in firm soil which has not been recently cultivated, except when the insects are migrating. When they are migrating eggs may be deposited most any place. Grasshoppers like sunshine and therefore their eggs are usually deposited upon the crests or on southern slopes of slightly elevated areas which are exposed to the sunshine. The eggs are about ⅕ inch long, curved, tapered toward each end, and vary from cream to brown in color.

Egg beds may be located by digging in the upper 3 inches of the soil with a knife, trowel or shovel. A very excellent method for sampling an infested area is to remove a ½ square foot area to the depth of about 2 inches by means of a square-ended shovel. The egg pods in the soil so removed are most readily detected by breaking the soil up sufficiently that it may be passed through a wire screen having four meshes per inch. Most of the egg pods are retained in the screen and should be counted. If more than five pods are found in this amount of soil and over large areas, the infestation is larger than normal and if other conditions are favorable will produce enough grasshoppers to make it necessary to apply control measures. If many more pods are found severe injury from 'hoppers may be expected the following season. *Whenever eggs are found in large numbers this fact should be reported at once to your county agent.*

The egg beds should be located in the autumn so that fall control measures may be practiced, if feasible, and hatching carefully watched the following spring.

Where to Look for the Young Grasshoppers

Young grasshoppers begin emerging from the soil as early as April and emergence may continue for a period of from 10 to 12 weeks, depending upon the species involved and the climatic conditions. They begin to feed soon after they emerge and grow very rapidly so that they may become adults in July or before. They feed in bands near the egg beds for several days after emerging, then separate and spread into the surrounding fields where they feed upon the green foliage. Very often, particularly if cold wet weather follows hatching for several successive days, many of the young 'hoppers are killed by exposure or disease or may starve to death. If, however, it is warm and dry most of them develop to maturity. *Weather conditions greatly influence populations but cannot be depended upon to control the grasshoppers.*

How To Control Grasshoppers

Grasshoppers may be controlled in two general ways: first, by fall cultivation of the egg beds; and second, by the use of poisoned bran bait. Under normal conditions the best and least expensive method is the use of poisoned bran bait. Under certain conditions, however, it may be advisable to use fall cultivation of the egg beds. Where fall cultivation is a part of the general farm practices it is always useful in keeping down the numbers of grasshoppers.

Fall Control

When grasshopper eggs are found in numbers large enough to indicate that severe injury may occur the following season, it is advisable to cultivate the egg beds in the fall. The best method of cultivation is deep plowing in the fall after the eggs have been deposited. This method may also be followed in the very early spring before the eggs have hatched. Deep plowing turns the eggs under the soil far enough so that they are not able to get to the surface before they die. In many localities it is desirable only to disk and harrow the soil in the fall. Disking should be followed with harrowing and the procedure repeated at intervals of about 10 days until the soil has become frozen. No type of cultivation should be done for grasshopper control until after the early hard frosts have killed all or most all of the adult grasshoppers. In alfalfa fields it is especially desirable to springtooth the fields in both directions in the fall so that the eggs may be exposed to drying conditions. In certain sections of the state where alfalfa diseases which might be spread by cultivation of the fields by springtoothing are present, this practice should not be followed.

Spring and Summer Control

The most successful means of controlling grasshoppers in the spring and summer is by the use of poisoned bran bait which must be applied at the right time to obtain the best results.

Poisoned bran bait is prepared according to the following formulae:

Formula 1

		Small amounts
Coarse bran (free from shorts)	100 pounds	10 pounds
Liquid sodium arsenite (four-pound material)	2 quarts	52 teaspoonfuls
Water	6 to 8 gallons	3 quarts
Molasses	2 gallons	1½ pints
Amyl acetate (Technical)	3 ounces	2 teaspoonfuls

If liquid sodium arsenite can not be obtained, use the following formula:

Formula 2

		Small amounts
Coarse bran (free from shorts)	100 pounds	10 pounds
White arsenic or Paris green	6 pounds	9½ ounces
Water	6 to 8 gallons	3 quarts
Molasses	2 gallons	1½ pints
Amyl acetate (Technical)	3 ounces	2 teaspoonfuls

One hundred pounds of bran and the corresponding amounts of other materials should poison 12 to 15 acres if not broadcast too thickly.

Bran. Bran is used as a carrier for the poison. The bran used in this bait must be coarse and must be free from shorts. Shorts cause the flakes of bran to stick together and form lumps which are very undesirable in bran bait.

Poison. Formula 1 is to be preferred because the liquid sodium arsenite is much more easily mixed into the bait and is less irritating to persons preparing the bait than the dry powdered form of poison. The poison used costs only about one-fourth as much as that in Formula 2. Formula 1 requires four-pound liquid sodium arsenite (four pounds of arsenic in each gallon of liquid). If eight-pound material can be obtained, use it at the rate of one quart of the liquid poison for each 100 pounds of bran. If sodium arsenite is not obtainable, white or crude arsenic or Paris green may be substituted as in Formula 2.

Molasses. The molasses makes the bait more attractive to the grasshoppers and aids in retaining the moisture for a longer period of time. The molasses used in this bait may be obtained from sugar refining companies and is the cheapest kind obtainable. It should be bought in 50- or 100-gallon drums.

Amyl acetate. Amyl acetate is used to attract the grasshoppers. It has a sweet, banana-like odor. Do not use more than the amount called for in the formula. The technical grade is recommended.

Water. Only enough water should be used to moisten the bran and not enough to make a sticky mixture. *Do not use an excess of water.*

How to Mix the Bait

The bait may be mixed on a concrete or wooden floor, in a tight wagon box, on a canvas, or in a tank. The bran should be spread out thinly and the liquid added very slowly while the whole mass is being mixed. The mixing should be done very thoroughly.

If Formula 1 is used, the molasses, sodium arsenite, and amyl acetate are mixed thoroughly with part of the water, then the liquid mixture, and finally the remainder of the water are added slowly to the bran as it is being mixed with a shovel, hoe or rake. After the necessary water has been added, re-shovel the bait until it is very uniformly moistened. The brain bait should be just moist enough so that when pressed in the hand it will not form a lump and when broadcast will break up into flakes.

If Formula 2 is used the powdered white arsenic or Paris green is first thoroughly mixed with dry bran. The amyl acetate and molasses are again mixed with water and the same procedure is followed as for Formula 1. Less irritation to the person mixing the bait will result if the dry poison is mixed directly into the liquids instead of into the bran. *It is very necessary, however, that this mixture be constantly stirred until it is applied to the bran.* The dry arsenical poisons are not soluble in the water and will, therefore, settle to the bottom of the mixing container if not constantly stirred. If the poison is allowed to settle to the bottom most of the arsenic will be put on a relatively small amount of the bran and in this way only a portion of the batch mixed will be effective.

How to Scatter the Bait

Grasshoppers begin to feed readily when the temperature reaches 65° F., and continue until it reaches 80° F. When the temperature goes above 80° F. they crawl up on a plant to escape the heat and do not feed on bran bait which is on the ground. This is a very important point to observe in the control of these insects. Grasshoppers feed only for short periods at any given time. The bait should not be scattered so early that it will dry out before the grasshoppers feed. The best time to broadcast the bait is just before the first morning feeding period. *The bait should be broadcast while the small grasshoppers are still in bands close to their breeding grounds and before they have scattered into the surrounding fields.* This means that the work should be done earlier in the year than it is ordinarily done. Do not wait until the grasshoppers have severely injured your crops. The insects can be poisoned after they have spread over larger areas but at a much greater cost. The bait is usually broadcast by hand. It should be thrown with a snap of the wrist so that it will completely separate into flakes. Lumpy bait should not be scattered in the fields because it is dangerous to livestock, poultry and birds, and the grasshoppers do not feed upon it readily. When a whole field is to be treated the poison may be scattered in strips one or two rods wide and at intervals of one or two rods, thus reducing the cost. When poisoning is done in hay fields at cutting time, a strip a few yards wide may be left uncut in the middle of the field. After three or four days the grasshoppers will have congregated in this strip and may be poisoned there with less bait. If young 'hoppers are migrating from adjacent fields, scatter the bait in strips about two rods wide across the path of migration.

UNIVERSITY OF ARIZONA

How to Judge Results

The poison used in this bait is slow in action and it may take several days before the grasshoppers are killed. After they have once fed, however, they become sick and do not cause further injury. Grasshoppers which have been killed by poisoned bran bait will attempt to crawl under some object before dying, so that one should search in the bottoms of the dry ditches, at the base of plants or under other objects for the dead insects. Poisoned bran bait can be relied upon to kill most of the grasshoppers in a field at any one time but it may be necessary to poison several times when attempting to stop a migrating band or when hatching continues over long periods of time. To do efficient work when the grasshoppers are hatching in large numbers it is necessary that communities be organized and that everyone cooperate in spreading the bait and in paying for the costs of the operation.

Danger to Animals

There is no danger to livestock, poultry or birds from eating the poisoned bait if it is properly scattered; that is, scattered so that it will not be found in lumps, but rather in individual flakes. All left-over materials both mixed and unmixed should be so disposed of that children or livestock cannot get to them. The poisons used in this bait are toxic to human beings if taken inwardly.

Predators, Parasites, and Diseases

Predators. Many of our wild and domestic birds as well as rodents feed upon the grasshoppers and their eggs. In large outbreaks of grasshoppers these animals cannot be depended upon to give any great degree of control, but their feeding always assists in keeping down the populations year after year.

Many egg pods are destroyed every year by the larvae of blister beetles and bee flies. In some years these predaceous insects are very important in the control of the grasshoppers while in other years they are of little consequence. Their value in control depends entirely on the size of their populations compared with that of the grasshoppers. The grub-like larvae of these insects are each capable of destroying all or nearly all of the eggs in one of the egg pods. The larvae of several species of ground and tiger beetles, solitary wasps and several other insects prey upon either the eggs or the young grasshoppers.

Parasites. Sarcophagid flies are among the most efficient parasites of grasshoppers. The maggots of these flies are deposited on the grasshoppers while the 'hoppers are flying. The maggots make their way into the bodies of the grasshoppers, eventually causing death by feeding on their vital organs.

Diseases. A fungous disease often destroys large numbers of grasshoppers during periods of cold wet weather especially in the early part of the life of the insect. This disease depends upon weather conditions and is therefore very sporadic in its occurrence. Its presence is indicated by many dead grasshoppers clinging to vegetation, especially near the top of the plants.